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THE TOP 100 MOST CITED ARTICLES ON NON-SURGICAL PERIODONTAL TREATMENT: A BIBLIOMETRIC ANALYSIS

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ABSTRACT

Non-surgical periodontal treatment primarily consists of scaling and root planing, which can be performed with either manual or powered instruments. Adjunctive treatments may include photodynamic therapy and the use of local or systemic antimicrobials. Scaling and root planing is the most well-documented and established therapy in the literature, demonstrating significant improvements in clinical parameters. This study conducted a bibliometric review of the 100 most-cited articles on non-surgical periodontal treatment. A search was performed in the Web of Science database using MeSH terms related to these treatments. From an initial 1,683 articles, the top 100 most-cited were selected. The most-cited article was by D'Aiuto et al., published in 2004. The authors with the highest number of publications were Socransky SS and Lindhe J, each appearing in six articles. The review identified 131 institutions involved in the studies, with the University of São Paulo being the

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most prominent. The studies originated from 20 countries, with the United States leading in the number of publications. The top 100 articles were published in 14 different journals, with the Journal of Clinical Periodontology being the most frequent. Wiley was the most common publisher. Frequently used keywords in the top 100 articles included "Disease," "periodontitis," "therapy," "inflammation," "Porphyromonas gingivalis," and "gingival crevicular fluid." The peak of publication activity occurred in 2005 and 2009. This study aims to highlight the importance of non-surgical periodontal treatments for the scientific community and their clinical applicability, guiding future research and researchers to key influential articles in this field.

Keywords: Periodontics. Periodontal Diseases. Therapeutics. Scaling. Root Planing.

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INTRODUCTION

Bibliometric analysis is a quantitative approach to examining scientific literature, focusing on patterns and metrics such as publication output, citation counts, and collaboration networks. This method provides valuable insights into the structure, development, and impact of research across various subjects [1].

Citation analysis, a core component of bibliometric analysis, uses citation data to quantify the influence of research by examining the number of references an article receives over time [2]. Analyzing the most frequently cited articles helps identify past, present, and emerging research trends within specific topics, as well as highlight the most prominent authors, journals, and institutions [2]. While citation rates are commonly regarded as indicators of a journal article's impact, they do not always reflect its quality [3].

Non-surgical periodontal treatment, involving manual, sonic, and/or ultrasonic instrumentation (scaling), is effective and preventive in controlling periodontal disease, increasing clinical attachment, and reducing probing depth in periodontal pockets [4]. Scaling and root planing, both supra- and subgingival, are considered the gold standard in dentistry for treating patients with periodontitis stages I-III [5]. In choosing the best treatment method, ultrasonic instruments are noted for being less traumatic to soft tissues, while manual instruments provide flatter surfaces and more effective calculus removal; however, in clinical practice, a combination of both is often used [6]. Additionally, other therapeutic approaches are available to aid in primary prevention in both experimental and practical settings, including antimicrobial photodynamic therapy, probiotics, prebiotics, symbiotics, statins, pro-resolution mediators, omega-3 and -6 fatty acids, ozone therapy, and epigenetic therapy [7].

Interestingly, it appears that the first citation analysis in dentistry was conducted in the field of Periodontology, when Nieri et al [8] identified and characterized the citation classics in periodontology, articles cited at least 100 times [8]. Since then, previous bibliometric analyses on periodontal disease have only evaluated the systemic manifestations of the periodontal disease [9], periodontal regeneration [10] and photodynamic therapy in periodontitis [11]. Although extensive research has been conducted on non-surgical periodontal treatment over time, attempts at citation analysis have yet to be made, to the best of our knowledge. This bibliometric review aims to uncover the relevance of the topic of non-surgical periodontal treatments by identifying data related to selected articles and distinguishing trends in scientific and technological growth, outlining

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a quantitative knowledge profile on the issue and serving as an indicator of scientific production in the field [12].

METHODOLOGY

A bibliometric review on the topic of non-surgical periodontal treatment was conducted using the Web of Science database from Clarivate Analytics. As this is a review study, it did not require approval from an ethics review board. The search was conducted on March 27, 2024, using the terms (Therapeutics OR Therapeutic OR Therapy OR Therapies OR Treatment OR Treatments) AND (Periodontics OR Periodontic OR Periodontal) AND (Non-surgical periodontal treatment OR Non-surgical Periodontal Therapy OR Non-Surgical OR Non-Surgical Procedures OR Non-Operative Procedures) in the title and/or abstract. The results were extracted into a table using Microsoft Excel and organized in descending order of citation count. The manuscripts were selected by two researchers, LCS and MSDP, independently and previously calibrated.

The study sample included publications that mentioned non-surgical periodontal treatment in the title and/or abstract and excluded those that did not address the studied topic. There were no restrictions on study design, publication year, language, or journal impact factor. The most-cited articles were manually stratified based on information retrieved from the Clarivate Analytics Web of Science database, including publication year, authors, number of citations, journals, keywords, contributing institutions, countries, and publishers. The address provided for the first author was used to determine the country of origin and the contributing institution of the article.

The most-cited articles were manually categorized based on information retrieved from the Clarivate Analytics Web of Science database, including publication year, authors, citation counts, journals, keywords, contributing institutions, countries, and publishers. The address provided for the first author was used to identify both the country of origin and the contributing institution of each article.

The relationships between authors were analyzed based on the frequency with which they cited each other, utilizing network visualization through VOSviewer software (Leiden University, Netherlands).

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RESULTS

The initial search identified 1.683 articles in the Web of Science database from Clarivate Analytics. After reviewing titles and abstracts, the 100 most-cited manuscripts related to non-surgical periodontal treatment were listed in order of ranking based on the number of citations in Table 1. The study selection process, including the search strategy used in the database, is summarized in a flowchart as shown in Figure 1.

FIGURE 1. Flowchart of the study selection process and search strategy

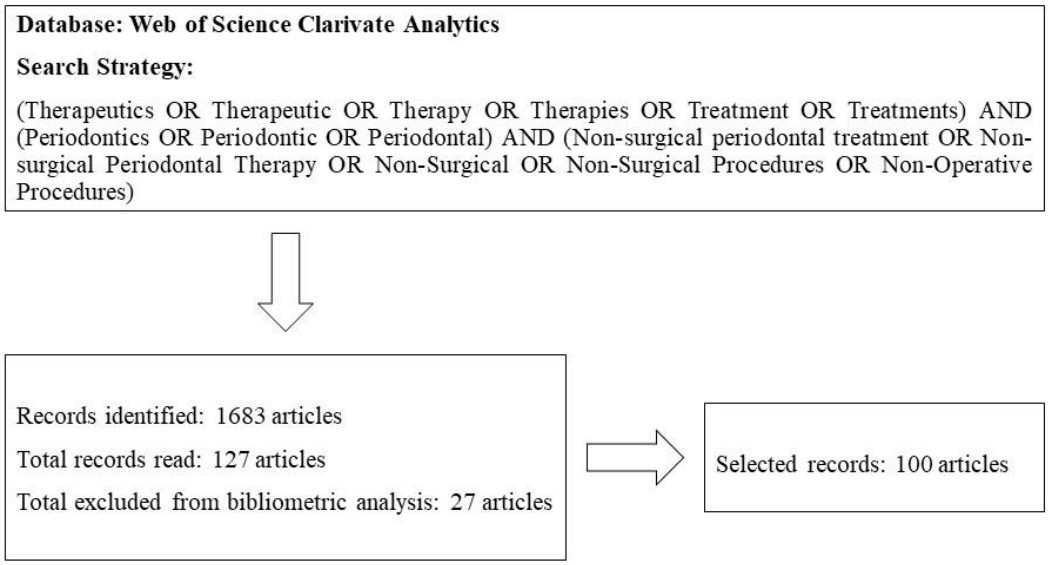

TABLE 1 – Ranking of the top 100 most-cited articles on non-surgical periodontal treatment

Ranking ou #	Author/Journal /ppublication year	Title	Instituition	Citations / Impact Factor	Average of citations per annum	Study model
1	D'Aiuto, F *et al*. JDR / 2004	Periodontitis and systemic inflammation: Control of the local infection is associated with a reduction in serum inflammatory markers	University College London	497 5,7	24,85	Clinical Trial
2	Badersten, A *et al*. JCP / 1981	Effect of non-surgical periodontal therapy. I. Moderately advanced periodontitis	Jouf University	476 5,8	11,07	Clinical Trial
3	Haffajee, AD et al. JCP / 1997	The effect of SRP on the clinical and microbiological parameters of periodontal diseases	Forsyth Dental Center	362 5,8	13,41	Clinical Trial
4	Lindhe, J et al. JCP / 1984	Long-term effect of surgical non-surgical	Royal School of Dentistry de Malmo¨	361 5,8	9,03	Clinical Trial

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		treatment of periodontal-disease				
5	Pihlstrom, BL et al. JCP / 1983	Comparison of surgical and non- surgical treatment of periodontal-disease - a review of current studies and additional results after 61/2 years	University of Minnesota	331 5,8	8,07	Literature review
6	Cobb, CM JCP / 2002	Clinical significance of non-surgical periodontal therapy: an evidence-based perspective of scaling and root planing	University of Missouri	334 5,8	14,73	Literature review
7	Lindhe, J *et al*. JCP / 1982	Healing following surgical non-surgical treatment of periodontal-disease – a clinical-study	University of Goteborg	314 5,8	7,48	Clinical Trial
8	Herrera, D et al. JCP / 2002	A systematic review on the effect of systemic antimicrobials as an adjunct to scaling and root planing in periodontitis patients	ComplutenseUniversity of Madrid	285 5,8	12,95	Systematic Review
9	Heitz-Mayfie D, LJA *et al*. JCP / 2002	A systematic review of the effect of surgical debridement vs. Non-surgical debridement for the treatment of chronic periodontitis	University of Berna	254 5,8	11,55	Systematic Review
10	Kaldahl, WB *et al*. JP / 1996	Long-term evaluation of periodontal therapy .1. Response to 4 therapeutic modalities	University of Nebraska	250 4,2	8,93	Clinical Trial
11	Ah, MKB *et al*. JCP / 1994	The effect of smoking on the response to periodontal therapy	University of Nebraska	236 5,8	7,87	Clinical Trial
12	Johnson, GK JP / 2004	Cigarette smoking and the periodontal patient	University of Iowa	235 4,2	11,75	Literature review
13	Kwon, T *et al*. IDJ / 2021	Current concepts in the management of periodontitis	Monadnok Perio & Implant Center	228 3,2	76	Literature review
14	Kiran, M *et al*. JCP / 2005	The effect of improved periodontal health on metabolic control in type 2 diabetes mellitus	Su leyman Demirel University	228 5,8	12	Clinical Trial
15	Ortiz, P *et al*.JP / 2009	Periodontal Therapy Reduces the Severity of Active Rheumatoid Arthritis in Patients Treated With or Without Tumor Necrosis Factor Inhibitors	Case Western Reserve University	2224,2	14,8	Clinical Trial
16	Herrera, D *et al*. JCP / 2008	Antimicrobial therapy in periodontitis:: the use of systemic antimicrobials against the subgingival biofilm	Complutense University of Madrid	222 5,8	13,88	Literature review

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17	Guerrero, A *et al*. JCP / 2005	Adjunctive benefits of systemic amoxicillin and metronidazole in non-surgical treatment of generalized aggressive periodontitis: a randomized placebocontrolled clinical trial	University College London	208 5,8	10,95	Clinical Trial
18	Cobb, CM JP / 2006	Lasers in periodontics: A review of the literature	University of Missouri	202 4,2	11,22	Literature review
19	Janket, SJ *et al*. JDR / 2005	Does periodontal treatment improve glycemic control in diabetic patients? A meta-analysis of intervention studies	Boston University	199 5,7	10,47	Systematic Review and Meta-analysis
20	Cugini, MA *et al*. JCP / 2000	The effect of scaling and root planing on the clinical and microbiological parameters of periodontal diseases: 12-month results	Forsyth Dental Center	198 5,8	8,25	Clinical Trial
21	Grossi, SG *et al*. JP / 1996	Response to periodontal therapy in diabetics and smokers	State University of New York	194 4,2	6,93	Clinical Trial
22	Morrison, EC *et al*. JCP / 1980	Short-term effects of initial, non-surgical periodontal treatment (hygienic phase)	University of Michigan	182 5,8	4,14	Clinical Trial
23	Salvi, GE JCP / 2005	Host response modulation in the management of periodontal diseases	University of Bern	173 5,8	9,11	Literature review
24	Schwarz, F *et al*. JCP / 2008	Laser application in non-surgical periodontal therapy: a systematic review	Heinrich Heine University	172 5,8	10,75	Systematic Review
25	D'Aiuto, F *et al*. JP / 2004	Periodontal disease and C-reactive protein-associated cardiovascular risk	University College London	164 4,2	8,2	Clinical Trial
26	Christgau, M *et al*. JCP / 1998	Healing response to non-surgical periodontal therapy in patients with diabetes mellitus: clinical, microbiological, and immunologic results	University of Regensburg	163 5,8	6,27	Clinical Trial
27	Wei, D *et al*. ADJ / 2010	Lipid peroxidation levels, total oxidant status and superoxide dismutase in serum, saliva and gingival crevicular fluid in chronic periodontitis patients before and after periodontal therapy	Changzhou Traditional Chinese Medical Hospital	162 1,9	11,57	Clinical Trial
28	Rodrigues, DC *et al*. JP / 2003	Effect of non-surgical periodontal therapy on glycemic control in	University of Sao Paulo	159 4,2	7,57	Clinical Trial

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		patients with type 2 diabetes mellitus				
29	Chondros, P *et al*. LMS / 2009	Photodynamic therapy as adjunct to non-surgical periodontal treatment in patients on periodontal maintenance: a randomized controlled clinical trial	Radboud University Medical Center	157 2,1	10,47	Clinical Trial
30	Schwarz, F *et al*. JP / 2001	Periodontal treatment with an Er:YAG laser compared to scaling and root planing.: A controlled clinical study	Ludwig Maximilians University	157 4,2	6,83	Clinical Trial
31	Czesnik iewicz-Guzik, M *et al*. EHJ / 2019	Causal association between periodontitis and hypertension: evidence from Mendelian randomization and a randomized controlled trial of non-surgical periodontal therapy.	University of Glasgow Faculty of Dentistry	156 37,6	31,2	Clinical Trial
32	Christodouli des, N *et al*.JP / 2008	Photodynamic therapy as an adjunct to non-surgical periodontal treatment: A randomized, controlled clinical trial	Radboud University Medical Center	1544,2	9,63	Clinical Trial
33	De Oliveira, RR *et al*. JP / 2007	Antimicrobial photodynamic therapy in the nonsurgical treatment of aggressive periodontits: A preliminary randomized controlled clinical study	University of Sao Paulo	153 4,2	9	Clinical Trial
34	Kaldahl, WB *et al*. JP / 1996	Levels of cigarette consumption and response to periodontal therapy	University of Nebraska Medical Center	149 4,2	5,32	Clinical Trial
35	Heasman, L *et al*. JCP / 2006	The effect of smoking on periodontal treatment response: a review of clinical evidence	University of Newcastle upon Tyne	144 5,8	8	Literature review
36	Stadler, AF et al. JCP / 2016	Gingival crevicular fluid levels of cytokines/chemokine s in chronic periodontitis: a metaanalysis	Federal University of Rio Grande do Sul	136 5,8	17	Systematic Review and Meta-analysis
37	Jeffcoat, MK *et al*. JP / 1998	Adjunctive use of a subgingival controlled-release chlorhexidine chip reduces probing depth and improves attachment level compared with scaling and root planing alone	University of Alabama At Birmingham	136 4,2	5,23	Clinical Trial
38	Adriaens, PA P / 2004	Effects of nonsurgical periodontal therapy on hard and soft tissues	Eastman Dental Institute	132 17,5	6,6	Literature review

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39	Cionca, N *et al*. JP / 2009	Amoxicillin and Metronidazole as an Adjunct to Full- Mouth Scaling and Root Planing of Chronic Periodontitis	University of Geneva	130 4,2	8,67	Clinical Trial
40	Chapple, ILC *et al*. JCP / 2007	Compromised GCF total antioxidant capacity in periodontitis: cause or effect?	University of Birmingham	128 5,8	7,53	Clinical Trial
41	Shimada, Y *et al*. JP / 2010	The Effect of Periodontal Treatment on Serum Leptin, Interleukin-6, and C-Reactive Protein	Niigata University	125 4,2	8,93	Clinical Trial
42	Navarro-Sanchez, AB *et al*. JCP / 2007	Effect of non-surgical periodontal therapy on clinical and immunological response and glycaemic control in type 2 diabetic patients with moderate periodontitis	Complutense University	125 5,8	7,35	Clinical Trial
43	Schar, D *et al*. COIR / 2013	Anti-infective therapy of peri-implantitis with adjunctive local drug delivery or photodynamic therapy: six-month outcomes of a prospective randomized clinical trial.	University of Berna	124 4,8	11,27	Clinical Trial
44	Vidal, F *et al*. JP / 2009	Periodontal Therapy Reduces Plasma Levels of Interleukin6, C-Reactive Protein, and Fibrinogen in Patients with Severe Periodontitis and Refractory Arterial Hypertension	State University of Rio de Janeiro	124 4,2	8,27	Clinical Trial
45	Berglun DH, T *et al*. JCP / 1998	The use of metronidazole and amoxicillin in the treatment of advanced periodontal disease - A prospective, controlled clinical trial	University of Gothenburg	121 5,8	4,65	Clinical Trial
46	Ince, G *et al*. JP / 2005	Clinical and Biochemical Evaluation of Lozenges Containing Lactobacillus reuteri as an Adjunct to NonSurgical Periodontal Therapy in Chronic Periodontitis	Yeditepe University	118 4,2	13,11	Clinical Trial
47	Renvert, S *et al*. COIR, 2009	Re-osseointegration on previously contaminated surfaces: a systematic review	Kristiansta d University	118 4,8	7,87	Systematic Review
48	Chambrone, L *et al*. JP / 2018	Antimicrobial photodynamic therapy for the treatment of periodontitis and peri-implantitis: An American Academy of	Ibirapuera University	116 4,2	19,33	Systematic Review and Meta-analysis

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		Periodontology best evidence review				
49	Marcaccini, AM *et al*.JCP / 2010	Gingival crevicular fluid levels of MMP-8, MMP-9, TIMP-2, and MPO decrease after periodontal therapy	University of Sao Paulo	1145,8	8,14	Clinical trial
50	Martin-Cabezas, R *et al*. JCP / 2016	Clinical efficacy of probiotics as an adjunctive therapy to non-surgical periodontal treatment of chronic periodontitis: a systematic review and meta-analysis	University of Strasbourg	113 5,8	14,13	Systematic review and meta-analysis
51	Correa, FOB *et al*. JCP / 2010	Effect of periodontal treatment on metabolic control, systemic inflammation and cytokines in patients with type 2 diabetes	Sao Paulo State University	113 5,8	8,07	Clinical trial
52	Greenstein, G JP / 1992	Periodontal response to mechanical nonsurgical therapy - a review	Columbia University	110 4,2	3,44	Literature review
53	Konig, J *et al*. JCP / 2002	Tooth loss and pocket probing depths in compliant periodontally treated patients: a retrospective analysis	University of Kiel	109 5,8	4,95	Clinical trial
54	Westfelt, E *et al*. JCP / 1996	The effect of periodontal therapy in diabetics - Results after 5 years	Public Dental Service	108 5,8	3,86	Clinical trial
55	Keestra, JAJ *et al*. JPR / 2015	Non-surgical periodontal therapy with systemic antibiotics in patients with untreated chronic periodontitis: a systematic review and meta-analysis	University Hospitals Leuven	107 3,4	11,89	Systematic review and meta-analysis
56	De Oliveira, RR *et al*. JP / 2009	Antimicrobial Photodynamic Therapy in the NonSurgical Treatment of Aggressive Periodontitis:Cytokine Profile in Gingival Crevicular Fluid, Preliminary Results	University of Sao Paulo	107 4,2	7,13	Clinical trial
57	Guentsch, A *et al*. COI, 2008	Lipid peroxidation and antioxidant activity in saliva of periodontitis patients: effect of smoking and periodontal treatment	University Hospital Jena	106 3,1	6,63	Clinical trial
58	Azarpaz hooh, A *et al*. JP / 2010	The Effect of Photodynamic Therapy for Periodontitis: A Systematic Review and Meta-Analysis	University of Toronto	105 5,8	7,5	Systematic review and meta-analysis
59	Chen, L *et al*. JP / 2012	Effects of Nonsurgical Periodontal Treatment on Clinical Response, Serum	Southern Medical University	103 4,2	8,58	Clinical trial

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		Inflammatory Parameters, and Metabolic Control in Patients with Type 2 Diabetes: A Randomized Study				
60	Rosling, B *et al*. JCP / 2001	Longitudinal peridontal tissue alterations during supportive therapy: Findings from subjects with normal and high susceptibility to periodontal disease	Gothenburg University	103 5,8	4,48	Clinical trial
61	Sanz, M JCP / 2008	Innovations in nonsurgical periodontal therapy: Consensus Report of the Sixth European Workshop on Periodontology	Complutense University of Madrid	102 5,8	6,38	Literature review
62	Lane, N *et al*. JP / 2005	Bisphosphonate therapy improves the outcome of conventional periodontal treatment: Results of a 12-month, randomized, placebocontrolled study	University of California San Francisco	102 4,2	5,37	Clinical trial
63	Kaldahl,WB *et al*. JP / 1993	A review of longitudinal-studies that compared periodontal therapies	University of Nebraska Medical Center	101 4,2	3,26	Systematic review
64	Tomasi, C *et al*. JCP / 2007	Factors influencing the outcome of nonsurgical periodontal treatment: a multilevel approach	The Sahlgrenk a at Goteborg University	100 5,8	5,88	Clinical trial
65	Xime nez-Fyvie, LA *et al*.JCP / 2000	The effect of repeated professional supragingival plaque removal on the composition of the supra- and subgingival microbiota	The Forsyth Institute	1005,8	4,17	Clinical trial
66	D'Aiuto, F *et al*. JCP / 2004	Periodontitis and atherogenesis: causal association or simple coincidence? A pilot intervention study	University College London	99 5,8	4,95	Clinical Trial - pilot study
67	Schwarz, F *et al*. JCP / 2003	Clinical evaluation of an Er:YAG laser combined with scaling and root planing for nonsurgical periodontal treatment -: A controlled, prospective clinical study	Heinrich Heine University of Du sseldorf	99 5,8	4,71	Clinical trial
68	Feres, M *et al*. JCP / 2012	Metronidazole alone or with amoxicillin as adjuncts to nonsurgical treatment of chronic periodontitis: a 1-year doubleblinded,placebocon trolled, randomized clinical trial	Guarulhos University	98 5,8	8,17	Clinical trial

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69	Koromantzos, PA *et al*. JCP / 2011	A randomized, controlled trial on the effect of non-surgical periodontal therapy in patients with type 2 diabetes. Part I: effect on periodontal status and glycaemic control	University of Athens	97 5,8	7,46	Clinical trial
70	Moreira, AI *et al*. JP / 2015	Antimicrobial Photodynamic Therapy as an Adjunct to NonSurgical Treatment of Aggressive Periodontitis: A Split-Mouth Randomized Controlled Trial	University of Sao Paulo	96 4,2	10,67	Clinical trial
71	Jonsson, B *et al*. JCP / 2009	The effectiveness of an individually tailored oral health educational programme on oral hygiene behaviour in patients with periodontal disease: a blinded randomized-controlled clinical trial (one-year follow-up)	Uppsala University	96 5,8	6,4	Clinical trial
72	Re, S *et al*. IJPRD / 2000	Orthodontic treatment in periodontally compromised patients: 12-year report	University of Turin	96 1,3	4	Clinical trial
73	Blomlof, JPS *et al*. JP / 1996	Smear removal and collagen exposure after non-surgical root planing followed by etching with an EDTA gel preparation	Karolinska Institutet	96 4,2	3,43	In vitro study
74	Shanbhag, S *et al*. JCP / 2012	The impact of periodontal therapy on oral health-related quality of life in adults: a systematic review	Queen Mary University of London	94 5,8	7,83	Systematic review
75	Duarte, PM *et al*. JP / 2010	Serum Levels of Cytokines in Subjects with Generalized Chronic and Aggressive Periodontitis Before and After NonSurgical Periodontal Therapy: A Pilot Study	Guarulhos University	94 4,2	6,71	Clinical Trial - pilot study
76	Faria-Almeida, R *et al*. JP / 2006	Clinical and metabolic changes after conventional treatment of type 2 diabetic patients with chronic periodontitis	Complutense University of Madrid	94 4,2	5,22	Clinical trial
77	Emingil, G *et al*. JP / 2004	The effect of adjunctive low-dose doxycycline therapy on clinical parameters and gingival crevicular fluid matrix metalloproteinase-8 levels in chronic periodontitis	Ege University	94 4,2	4,7	Clinical trial

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78	Schwarz, F *et al*. JP / 2003	Periodontal treatment with an Er:YAG laser or scaling and root planing.: A 2-year follow-up split-mouth study	Heinrich Helne University	94 4,2	4,48	Clinical trial
79	Seymour, RA JCP / 1995	Tetracyclines in the management of periodontal-diseases - a review	Dental School	94 5,8	3,24	Literature review
80	Preshaw, PM *et al*.JCP / 2005	The effect of quitting smoking on chronic periodontitis	University of Newcastle upon Tyne	935,8	4,89	Clinical trial
81	Lappin, DF *et al*. JCP / 2013	Influence of periodontal disease, Porphyromonas gingivalis and cigarette smoking on systemic anticitrullinated peptide antibody titres	University of Glasgow	92 5,8	8,36	Clinical trial
82	Mercanoglu, F *et al*. JP / 2004	Endothelial dysfunction in patients with chronic periodontitis and its improvement after initial periodontal therapy	Istanbul University	92 4,2	4,6	Clinical trial
83	Preber, H *et al*. JPC / 1995	Periodontal healing and periopathogenic microflora in smokers and nonsmokers	Karolinska Institutet	92 5,8	3,17	Clinical trial
84	Zandbergen, D *et al*. JP / 2013	The Clinical Effect of Scaling and RootPlaning and the Concomitant Administration of Systemic Amoxicillin and Metronidazole: A Systematic Review	University of Amsterdam and VU University	91 4,2	8,27	Systematic review
85	Marcaccini, AM *et al*. JP / 2009	Circulating Interleukin-6 and High-Sensitivity C-Reactive Protein Decrease After Periodontal Therapy in Otherwise Healthy Subjects	University of Sao Paulo	90 4,2	6	Clinical trial
86	Aykol, G *et al*. JP / 2011	The Effect of LowLevel Laser Therapy as an Adjunct to Non-Surgical Periodontal Treatment	Istanbul University	89 4,2	6,85	Clinical trial
87	Renvert, S et al. JCP / 1998	The clinical and microbiological effects of nonsurgical periodontal therapy in smokers and non-smokers	Kristianstad University College of Health Sciences	89 5,8	3,42	Clinical trial
88	Teshome, A BMCOH / 2016	The effect of periodontal therapy on glycemic control and fasting plasma glucose level in type 2 diabetic patients: systematic review and meta-analysis	University of Gondar	87 2,6	10,88	Systematic review and meta-analysis
89	Westfelt, E *et al*. JCP / 1998	The effect of supragingival plaque control on the progression of advanced periodontal disease	Goteborg University	87 5,8	3,35	Clinical trial

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90	Betsy, J *et al*. JCP / 2014	Efficacy of antimicrobial photodynamic therapy in the management of chronic periodontitis: a randomized controlled clinical trial	Government Dental College	86 5,8	8,6	Clinical trial
91	Koshy, G et al. JCP / 2005	Effects of single-visit full-mouth ultrasonic debridement versus quadrant-wise ultrasonic debridement	Tokyo Medical and Dental University	86 5,8	4,53	Clinical trial
92	Sigusch, B *et al*. JP / 2001	A 2-step non-surgical procedure and systemic antibiotics in the treatment of rapidly progressive periodontitis	Friedrich Schiller University of Jena	85 4,2	3,7	Clinical trial
93	Rooney, J *et al*. JCP / 2002	Adjunctive effects to non-surgical periodontal therapy of systemic metronidazole and amoxycillin alone and combined - A placebo controlled study	Dental School	84 5,8	3,82	Clinical trial
94	Braatz, L *et al*. JCP / 1985	Antimicrobial irrigation of deep pockets to supplement nonsurgical periodontal therapy .2. Daily irrigation	Loma Linda University	83 5,8	2,13	Clinical trial
95	Tarannum, F JP / 2007	Effect of periodontal therapy on pregnancy outcome on women affected by periodontitis	M.R. Ambedkar Dental College and Hospital	82 4,2	4,82	Clinical trial
96	Palmer, RM *et al*.JCP / 1999	Non-surgical periodontal treatment with and without adjunctive metronidazole in smokers and nonsmokers	United Medical and Dental School of Guy's Hospital	815,8	3,24	Clinical trial
97	Walmsley, AD *et al*. JCP / 2008	Advances in power driven pocket/root instrumentation	The University of Birmingha m	80 5,8	5	Literature review
98	Matthews, DC. JP / 1993	Evaluating patient perceptions as shortterm outcomes of periodontal treatment - a comparison of surgical and nonsurgical therapy	University of Toronto	80 4,2	2,58	Observatio nal Study
99	Kaur, S *et al*. SAR / 2014	Does periodontal treatment influence clinical and biochemical measures for rheumatoid arthritis? A systematic review and meta-analysis	University of Adelaide	79 4,6	7,9	Systemtic review and meta-analysis
100	Mascarenhas, P *et al*. JP / 2005	Clinical response of azithromycin as an adjunct to nonsurgical periodontal therapy in smokers	University of Michigan	79 4,2	4,16	Clinical trial

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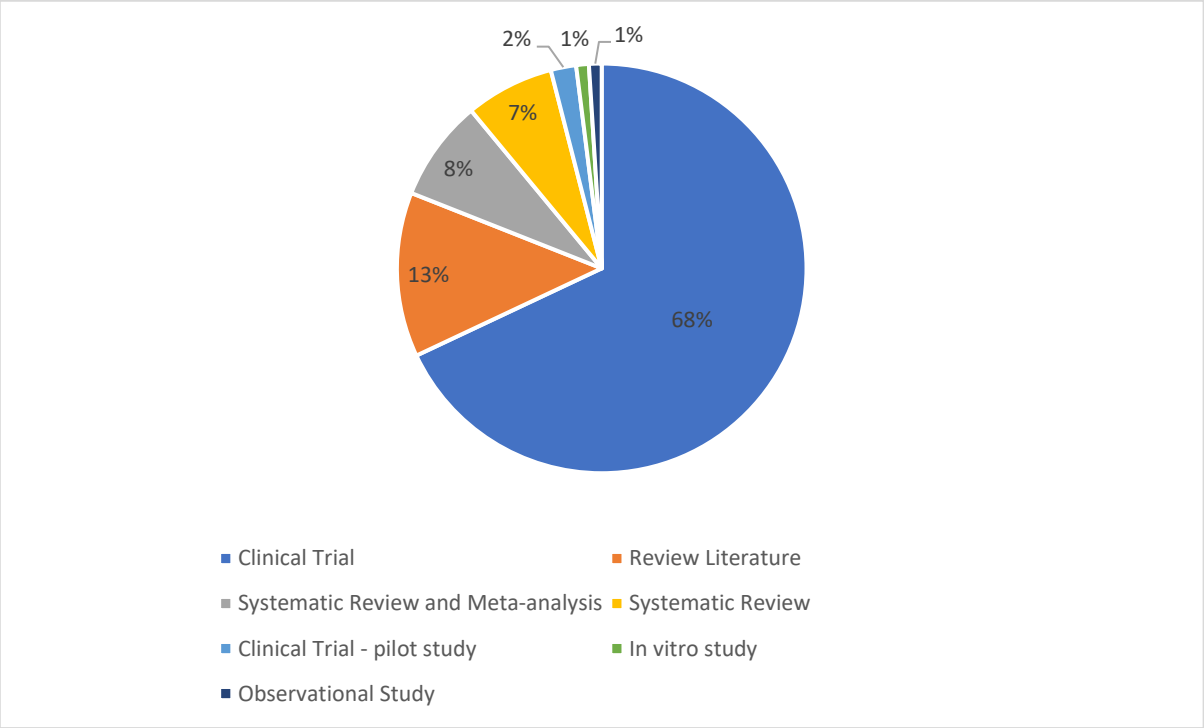
TYPES OF STUDIES, PUBLICATIONS, AND AUTHOR CITATIONS

Among the top 100 most-cited articles in the field of non-surgical periodontal treatment, 68% are clinical trials and 13% are literature reviews. The remaining studies are divided among systematic reviews, systematic reviews and meta-analyses, pilot clinical trials, in vitro studies, and observational studies, as shown in Figure 2.

FIGURE 2. Types of studies among the top 100 most-cited articles on non-surgical periodontal treatment



The number of authors per article ranged from 1 to 20 (mean 5.13 ± 2.70), totalling 426 authors and co-authors across the 100 most-cited articles on non-surgical periodontal treatment. The authors and co-authors with the highest number of publications were Socransky SS (appearing in 6 articles), Lindhe J (6 articles), and Westfelt E (5 articles). Approximately 426 authors and co-authors appeared in only one article each. Figure 3 provides a graphical representation of the network among the authors and co-authors in these articles, highlighting minimal interaction between them.

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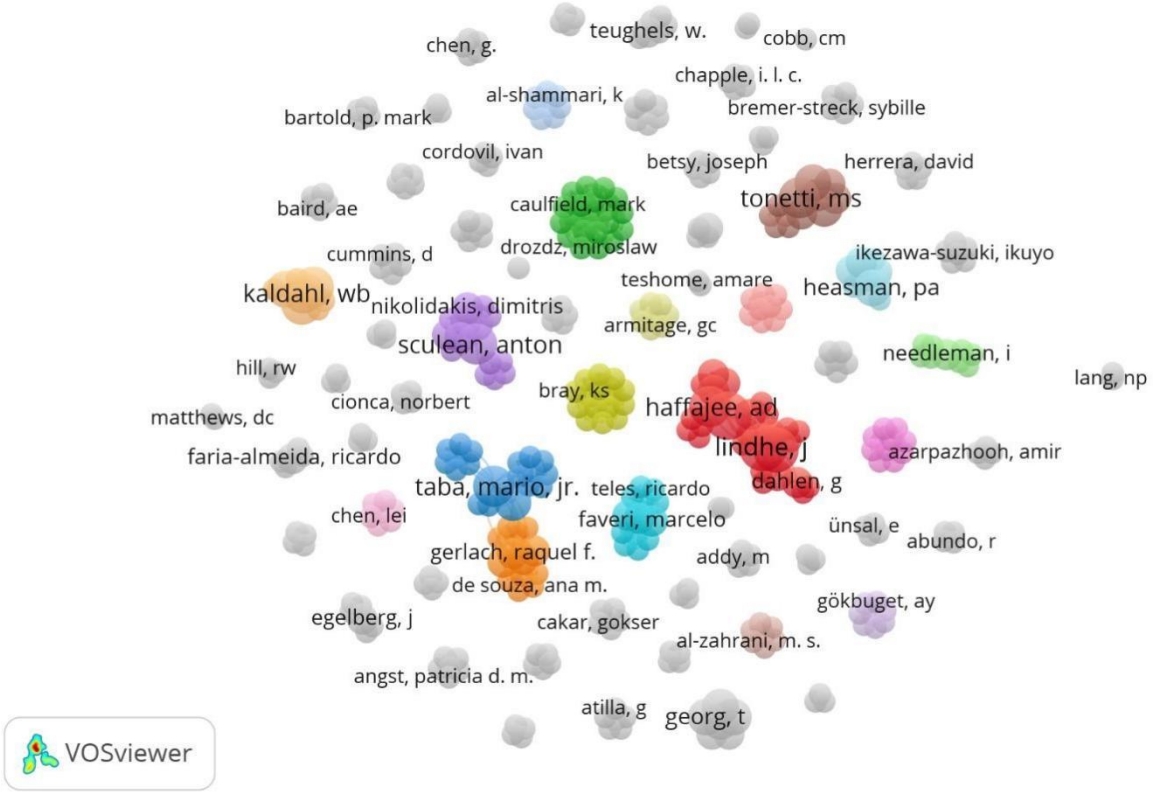
FIGURE 3. Network of authors and co-authors in the bibliometric research on non-surgical periodontal treatment



The most-cited articles in the top 100 were led by D'Aiuto F and collaborators in 2004 [13] with a total of 497 citations, followed by Badersten and collaborators in 1981 [14] with 476 citations, Haffajee and collaborators in 1997 [15] with 362 citations, and Lindhe and collaborators in 1984 [16] with 361 citations of their article. The number of citations ranged from 79 to 497 (mean 146.55 ± 81.99). Approximately 65 articles received 100 or more citations (Table 1). The oldest manuscript in this bibliometric analysis was published in 1980 by Morrison and collaborators [17] in the Journal of Clinical Periodontology (JCP) and was cited 182 times, while the most recent was published in 2021 by Kwon and collaborators [18] in the International Dental Journal (IDJ) and was cited 228 times.

Figure 4 shows the correlation between the number of citations and the publication year of the studies among the 100 most-cited articles on non-surgical periodontal treatment. The citation distribution line shows peaks in the years 2004 and 2005, with the highest citation totals for the top 100 studies, at 1313 and 1168, respectively.

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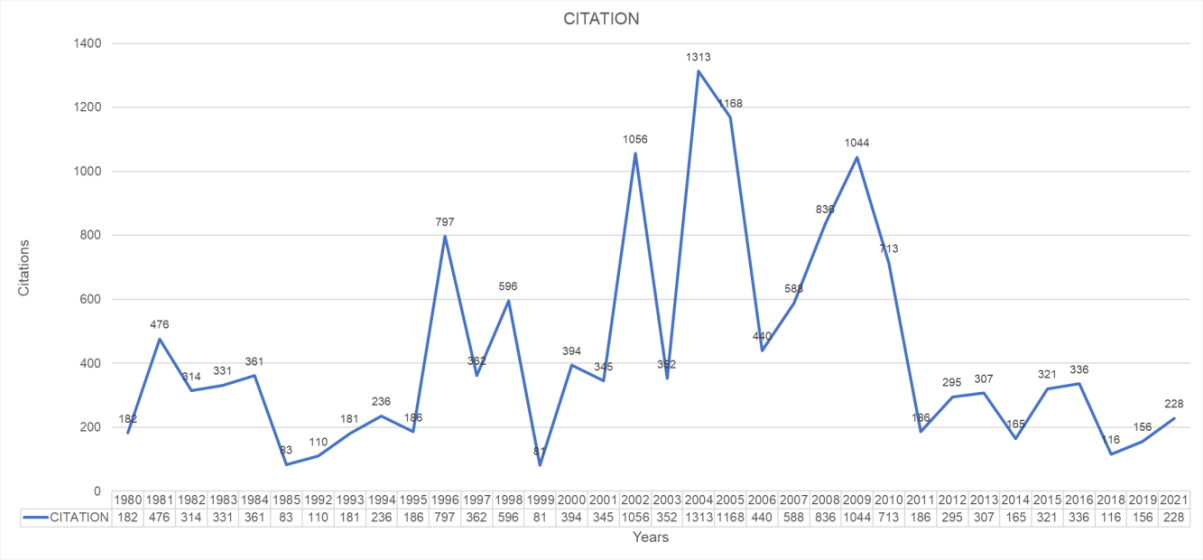
FIGURE 4. Correlation between the number of citations and the publication year of the studies.



INSTITUTIONS AND COUNTRIES

A total of 131 different institutions were listed in these studies. The University of São Paulo led the list with 6 manuscripts published among the top 100 most cited; followed by the University of Texas and University College London, both with 5 articles each, as shown in Figure 5. When considering only the institutions of the first author, this number drops to 71 institutions, as can be seen in Table 2. The most notable institutions were the University of São Paulo, which led the list with 6 manuscripts published, followed by Complutense University of Madrid with 5 manuscripts, and University College London and University of Nebraska with 4 manuscripts published among the top 100 most cited.

FIGURE 5. Correlation between the institutions of all authors and co-authors. The larger the number of publications from these institutions, the larger the circles.

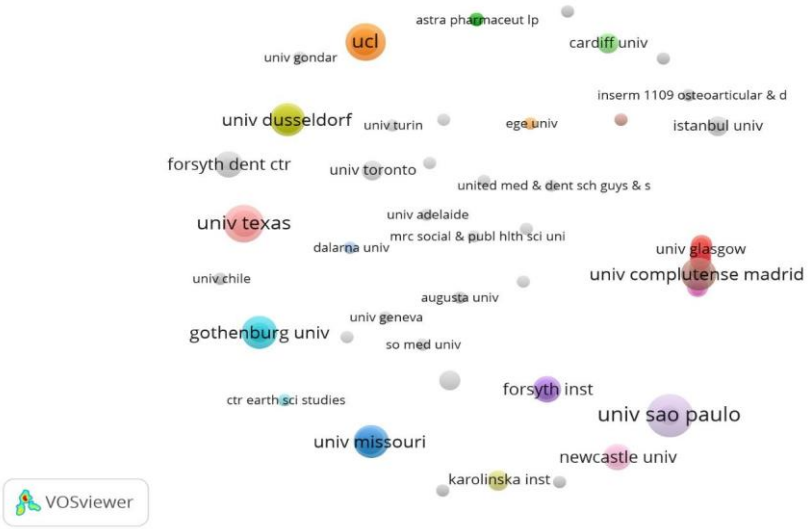


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TABLE 2. Correlation between the first author institutions, number of publications, and citations in the top 100 most cited articles on non-surgical periodontal treatment.

First Author's Institutions	Number of articles	Total citations
University of Sao Paulo	6	719
Complutense University of Madrid	5	828
University of Nebraska	4	736
University College London	4	968
University of Bern	3	551
University of Toronto	2	185
Forsyth Dental Center	2	560
Radboud University Medical Center	2	311
Dental School	2	178
Guarulhos University	2	192
University of Glasgow	2	248
Heinrich Heine University of Düsseldorf	2	193
Kristianstad University College of Health Sciences	2	207
Istanbul University	2	181
University of Michigan	2	261
Karolinska Institutet	2	188
University of Missouri	2	526
Case Western Reserve University	1	222
Universidade Heinrich Heine	1	172
University of Iowa	1	235
Jouf University	1	476
University of Adelaide	1	79
Ege University	1	94
Changzhou Traditional Chinese Medical Hospital	1	162
Federal University of Rio Grande do Sul	1	136
Tokyo Medical and Dental University	1	86
Loma Linda University	1	83
University Hospital Jena	1	106
Ludwig Maximilians University	1	157
University of Amsterdam and VU University	1	91
M.R. Ambedkar Dental College and Hospital	1	82
University of California-San Francisco	1	102
Monadnock Perio & Implant Center	1	228
University of Göteborg	1	314
Niigata University	1	125
Ibirapuera University	1	116
Public Dental Service	1	108
United Medical and Dental School of Guy's Hospital	1	81
Queen Mary University of London	1	94
Government Dental College	1	86
Columbia University	1	110
University Hospitals Leuven	1	107
University of Minnesota	1	331
University of Alabama at Birmingham	1	136
Friedrich Schiller University of Jena	1	85

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University of Athens	1	97
Göteborg University	1	87
University of Birmingham	1	128
Gothenburg University	1	103
University of Geneva	1	130
Uppsala University	1	96
University of Gondar	1	87
Universidade de Newcastle	1	144
University of Gothenburg	1	121
Boston University	1	199
University of Kiel	1	109
The Sahlgrenska Academy at Göteborg University	1	100
Eastman Dental Institute	1	132
The University of Birmingham	1	80
Royal School of Dentistry de Malmö	1	361
University of Regensburg	1	163
São Paulo State University	1	113
University of Strasbourg	1	113
Southern Medical University	1	103
University of Turin	1	96
State University of New York	1	194
Yeditepe University	1	118
State University of Rio de Janeiro	1	124
University of Newcastle	1	93
Süleyman Demirel University	1	228
The Forsyth Institute	1	100
Total	**100**	**14655**

The studies originated from 20 different countries when considering only the location of the first author. The total number of citations from all countries was 14,655, with the United States alone accounting for 4,023 citations, as shown in Table 3. The leading countries were the United States with 21 articles, the United Kingdom with 15 articles, and Brazil and Sweden with 12 articles each among the top 100 articles on non-surgical periodontal treatment. Figure 6 shows the world map with the countries of the first authors highlighted in blue. When considering the country of all authors and co-authors, the number of originating countries increases to 29. In this case, the United States remains in first place with 29 manuscripts, followed by England with 17 manuscripts, and Germany and Brazil with 12 manuscripts each, as shown in Figure 7.

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FIGURE 6. World map highlighting the countries of origin for the top 100 most cited articles on non-surgical periodontal treatment. The more publications from these countries, the darker the shade of blue.

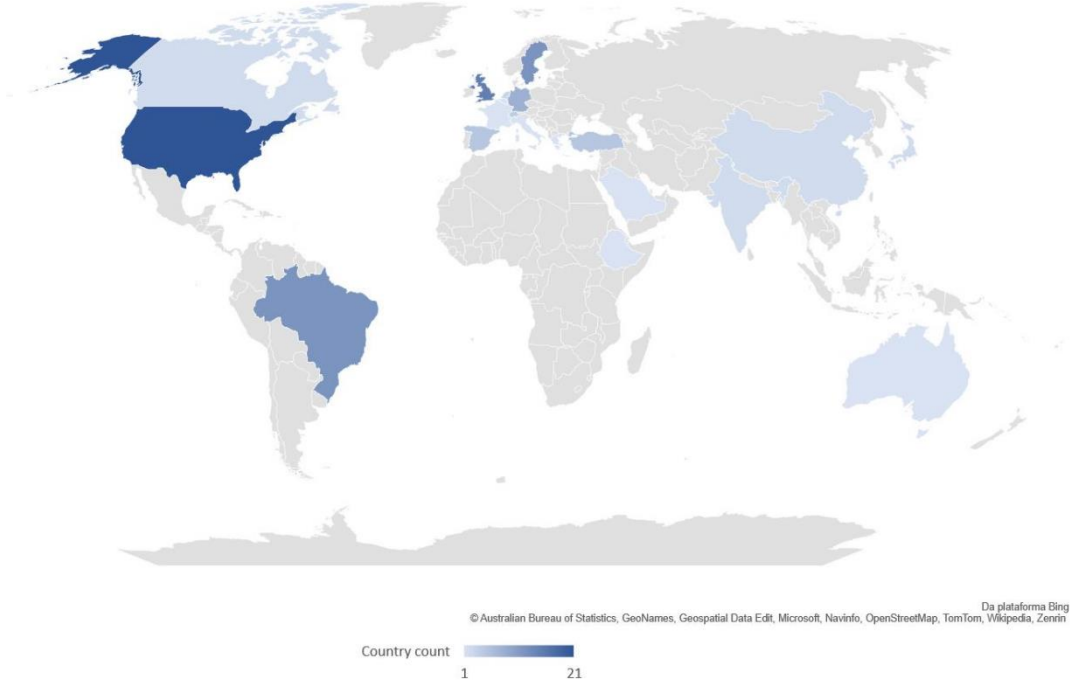

FIGURE 7. Network analysis of the leading countries based on the bibliographic research on non-surgical periodontal treatment. The size of the circles is related to the countries and their number of publications.

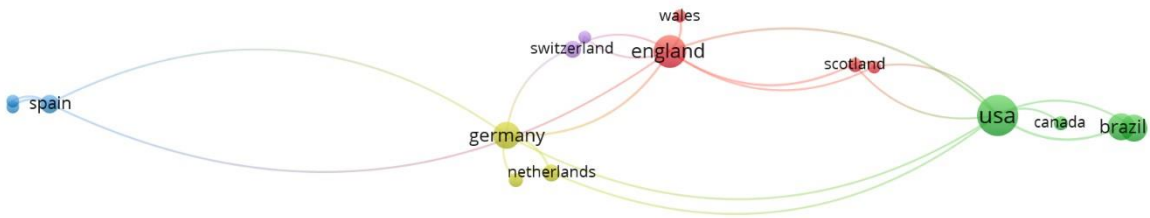

TABLE 3. Number of published articles and number of citations by each country of origin among the top 100 most cited articles on non-surgical periodontal treatment.

Country Of the First Author	Number of Articles	Number of Citations
United States	21	4023
United Kingdom	15	2146
Sweden	12	1685

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Brazil	12	1400
Germany	8	985
Spain	5	828
Turkey	5	621
Switzerland	4	681
Netherlands	3	402
India	2	168
Japan	2	211
China	2	265
Canada	2	185
Belgium	1	107
Australia	1	79
Saudi Arabia	1	476
Italy	1	96
France	1	113
Greece	1	97
Ethiopia	1	87
Total	100	14655

JOURNALS AND PUBLISHERS

The top 100 most cited articles on non-surgical periodontal treatment were published in 14 different journals. Among the leading ones are the Journal of Clinical Periodontology (JCP), which leads the ranking with 49 articles, followed by the Journal of Periodontology (JP) with 37 articles, as shown in Figure 8.

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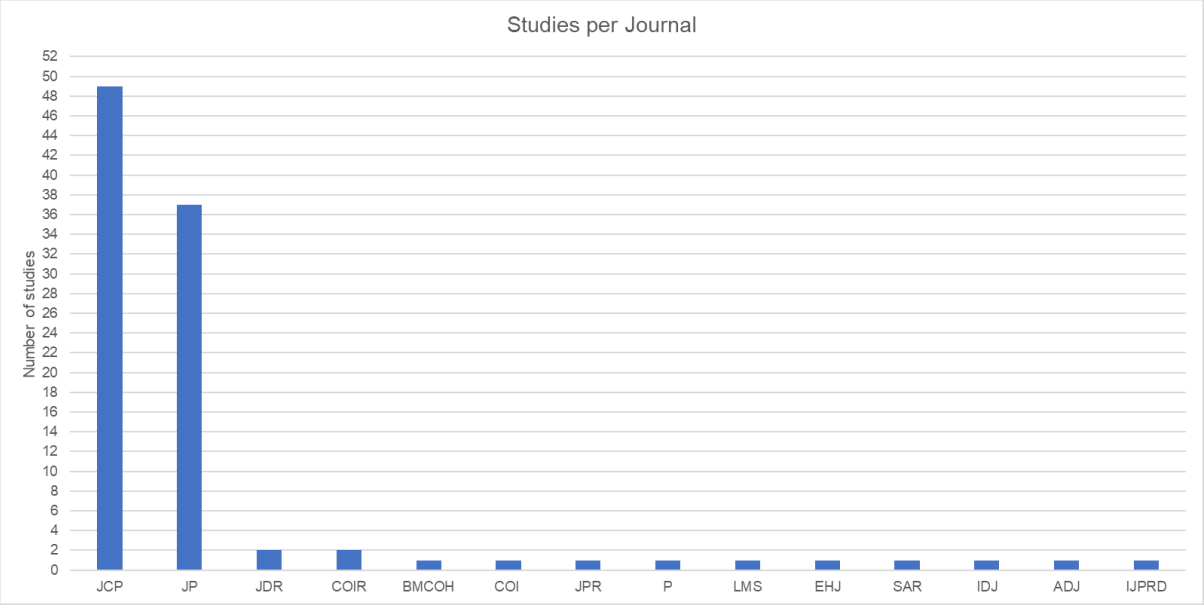
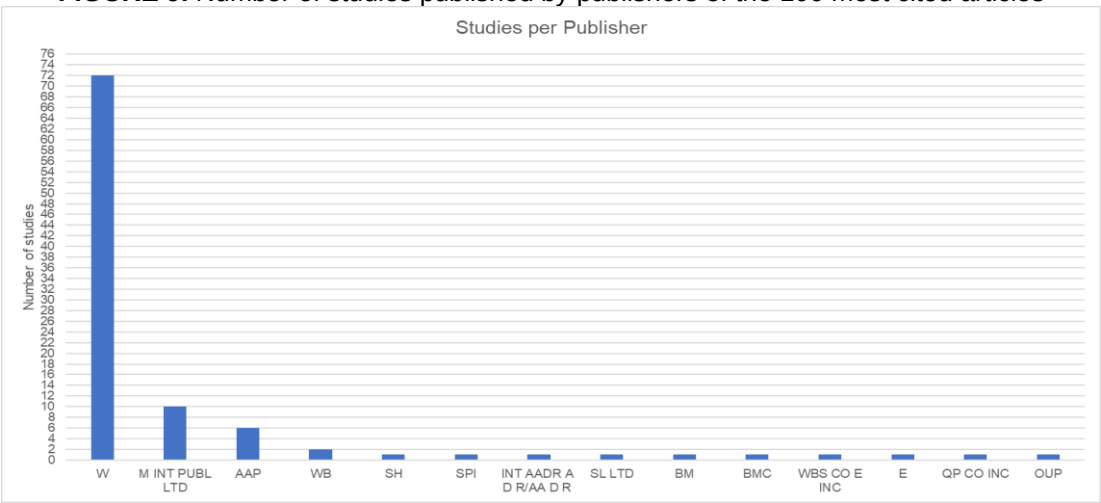
FIGURE 8. Number of studies published by Periodicals



Legend: Journal of Clinical Periodontology (JCP) – Journal of Periodontology (JP) – Journal of Dental Research (JDR) - Clinical Oral Implants Research Dentistry (COIR) – BMC Oral Health (BMCOH) - Clinical Oral Investigations (COI) – Journal of Periodontal Research (JPR) – Periodontology 2000 (P) – Lasers In Medical Science (LMS) – European Heart Journal (EHJ) - Seminars In Arthritis and Rheumatism (SAR) – International Dental Journal (IDJ) – Australian Dental Journal (ADJ) – International Journal of Periodontics & Restorative Destistry (IJPRD)

A total of 14 publishers were found in this search. The largest number of the top 100 most cited articles was published by Wiley (W) with 72 studies, followed by Munksgaard Int Publ LTD (M INT PUBL LTD) with 10 studies and American Academy of Periodontology (AAP) with 6 published studies as shown in Figure 9.

FIGURE 9. Number of studies published by publishers of the 100 most cited articles



Legend: Wiley (W) - Munksgaard Int Publ Ltd (M INT PUBL LTD) - Amer Acad Periodontology (AAP) - Wiley-Blackwell (WB) - Springer Heidelberg (SH) - Sage Publications Inc (SPI) - Int Amer Assoc Dental Researchi A D R/A A D R (INT AADR A A R/AA D R) - Springer London Ltd (SL LTD) - Blackwell Munksgaard (BM) - Bmc Oral Health (BMC) - W B Saunders Co-Elsevier Inc (WBS CO E INC) – Elsevier (E) - Quintessence Publishing Co Inc (QP CO INC) - Oxford Univ Press (OUP).

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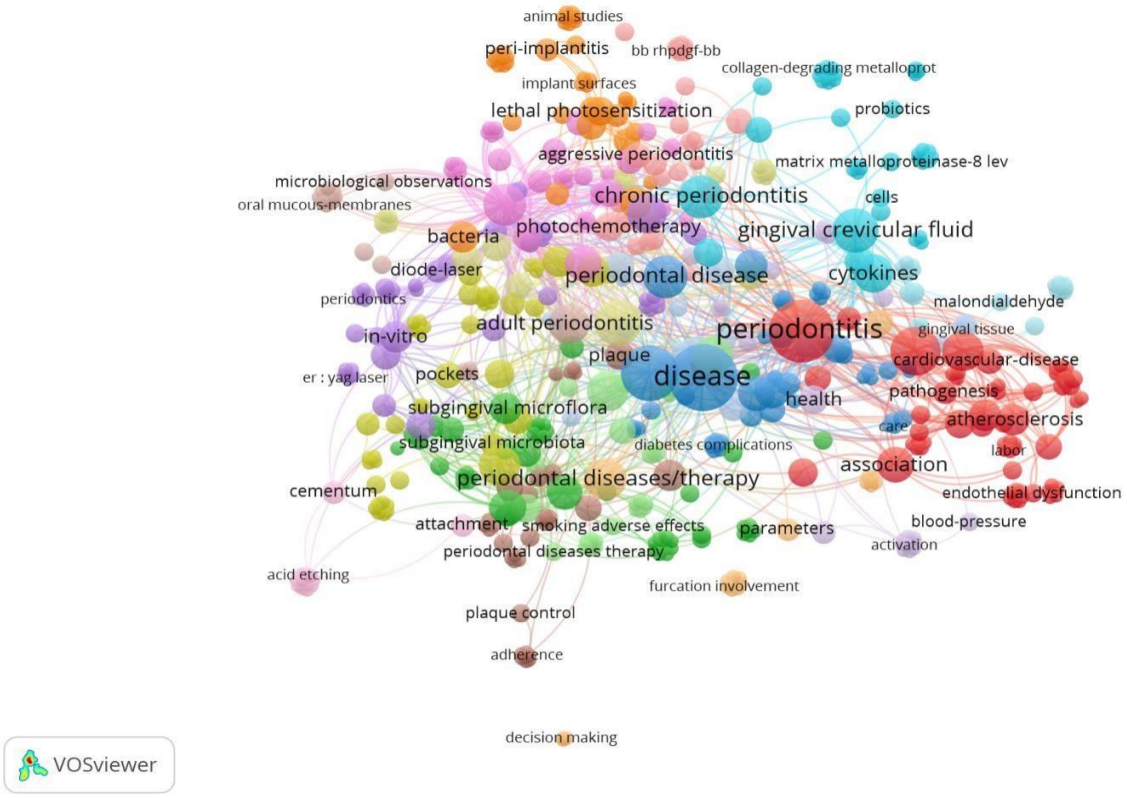
KEYWORDS

In total, 633 keywords were used. The most used keywords in this list of the top 100 articles were: Disease (33 articles), periodontitis (28 articles), therapy (21 articles), inflammation (16 articles), porphyromonas-gingivalis (14 articles), gingival crevicular fluid (13 articles), chronic periodontitis (12 articles) and periodontal disease (12 articles). The most used keyword was repeated in 33 studies, and the frequency of keyword use varied between 1 and 33 repetitions. Figure 10 shows a graphical representation in the form of a map of the keywords.

FIGURE 10. Keyword network analysis of literature search on non-surgical periodontal treatment. The sizes of the circles are related to the number of citations for each keyword used.



TEMPORAL PATTERN OF PUBLICATIONS

Based on the distribution of the 100 articles over the years, 2005 and 2009 had the highest concentration of publications, with 8 studies in each year, as shown in Figure 11. Among the most cited, the most recent study is from 2021.

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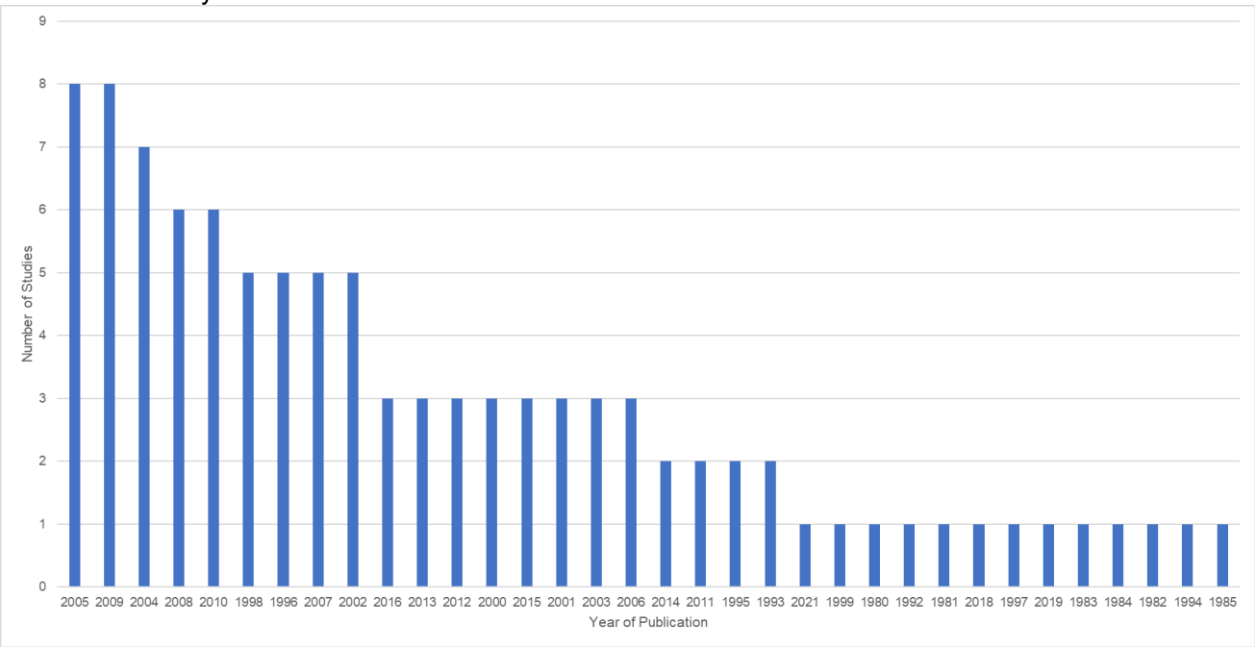
FIGURE 11. Temporal distribution of the 100 most cited studies on treatment non-surgical periodontal treatment over the years.



DISCUSSION

The most prominent type of non-surgical periodontal treatment highlighted in this bibliometric study was conventional therapy, commonly known as manual or mechanized scaling and root planing, which uses curettes, scalers, and files along with ultrasonic instrumentation. Photodynamic therapy (PDT), cited as a key adjunctive treatment, involves the use of low-frequency infrared or visible light that produces reactive oxygen species with a toxic effect on bacteria [7], combined with photosensitizers such as toluidine blue, methylene blue, and indocyanine green [19].

The systemic antimicrobials most frequently mentioned in the articles were metronidazole and amoxicillin, used both as monotherapy and as adjuncts to scaling procedures. When administered as an adjunct to scaling and root planing, these antimicrobials offer benefits such as reducing deep pockets, clinical attachment levels, and bleeding on probing, as well as reaching pathogenic microorganisms that have already established themselves in the tissue [20].

The most cited publication in the ranking is a clinical trial with 497 citations [13], with an average of 24.85 citations per year, published in the Journal of Dental Research, which has an impact factor of 5.7. The aim of this article was to evaluate whether the degree of response to non-surgical periodontal therapy was associated with changes in systemic inflammation biomarkers. They monitored periodontal parameters as well as inflammatory

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markers such as C-reactive protein (CRP) and Interleukin-6 (IL-6). They concluded that individuals who exhibited a clinical response above average to non-surgical periodontal treatment experienced a reduction in the studied biomarkers. This finding is supported by current literature, which states that severe forms of periodontal disease can cause low-grade systemic inflammation, increasing susceptibility to cardiovascular disease [21]. Thus, the 2004 clinical study presents data that remain relevant today, validating its top position in the citation ranking and its importance in the literature. The fact that it was published in a high-impact scientific journal may also have contributed to its leading citation status in this field.

The second most cited article [14] has a total of 476 citations and an average of 11.07 citations per year, published in the Journal of Clinical Periodontology. This clinical study focused on non-surgical periodontal treatment in 4 to 7 mm pockets, performing plaque control and supra- and subgingival debridement using both manual and ultrasonic instruments. They observed no differences between manual instruments and ultrasonics. They noted that parameters improved during the first 4-5 months of treatment, with little change over the remaining 13 months. These results have been corroborated by contemporary research, including a randomized controlled clinical trial that tested different scaling and root planing strategies and confirmed that all clinical parameters significantly improved with decreased pocket depth, regardless of the approach [22].

The types of studies found in the ranking of the top 100 most cited articles on non-surgical periodontal treatment are varied, including: clinical trials, literature reviews, systematic reviews, systematic reviews with meta-analyses, retrospective cohort studies, and reports. Clinical trials are the most numerous, accounting for 68% of the publications. They play a significant role in the literature, as they are effective in providing evidence-based proof and contribute to the development and refinement of new treatment methods [23].

In this bibliometric review, clinical trials have contributed to a better understanding of specific non-surgical periodontal treatments, highlighting the need for experimentation and analysis of clinical parameters such as clinical attachment level, probing depth, plaque index, bleeding on probing, and number of missing teeth to better evidence therapeutic approaches and how they respond according to each patient and their periodontal disease. This was proposed in the third-ranked article [15], published in the Journal of Clinical Periodontology. In this clinical study, 57 individuals with periodontitis were monitored at 3, 6,

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and 9 months, with scaling and root planing treatments applied to both clinical and microbiological parameters, resulting in significant improvements such as decreased prevalence and levels of bacteria like *P. gingivalis*, *T. denticola*, and *B. forsythus*.

The total number of authors and co-authors in the ranking was 426. The authors with the highest number of publications on non-surgical periodontal treatment were Sigmund Socransky and Jan Lindhe, each with 6 articles. Sigmund Socransky, a renowned periodontal microbiologist, was a Senior Member and Head of the Department of Periodontology at the Forsyth Dental Center for 50 years, with over 300 published manuscripts, significantly contributing to science and periodontal microbiology. Since 2005, he has been cited over 750 times per year collectively [24]. Jan Lindhe, the other leading author, is known for several renowned books in periodontology, such as the Clinical Periodontology and Implant Dentistry, reflecting the substantial influence both authors have had on the scientific literature.

Another factor analyzed was the year of publication of each study in relation to the number of citations. According to this correlation, the majority of citations occurred in the years 2004 and 2005, with 1,113 and 1,168 citations respectively. The oldest publication is from 1980, a clinical study [17] aimed at analyzing non-surgical periodontal treatment in patients with pocket depths up to 4 mm, including scaling and root planing, oral hygiene instructions, and occlusal adjustment. The most recent publication is from 2021 with 228 citations [18]. This literature review covers current concepts in periodontitis treatment, including prevalence, etiology, disease progression, diagnosis, risk factors, contributing factors, and treatment, which explains its 13th place ranking despite being the most recent article published.

Regarding institutions, 131 are associated with the selected articles. The institution with the highest number of publications is the University of São Paulo, with 6 published manuscripts, followed by the University of Texas and University College London, each with 5 articles. However, when considering only the institution of the first author, the number of universities drops to 79, yet Brazil remains in first place in terms of publication quantity, with a total of 719 citations. Analyzing the correlation between the institution of the first author, number of published articles, and number of citations, the University of São Paulo still ranks first with 6 publications, followed by the University of Texas with 5, and University College London with 4 publications, the latter being responsible for publishing the most cited article

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in the ranking, highlighting its influence in this bibliometric review. These data indicate the most active research centers involved in non-surgical periodontal treatment studies.

Countries of the first authors were also classified by the number of publications and citations. A total of 20 countries were identified, demonstrating a variety of academic and cultural settings within the assessed topic. Notably, the United States ranks first, the United Kingdom second, followed by Sweden and Brazil tied for third. This analysis reflects a broad pursuit of advancement and application in non-surgical periodontal treatment studies on a global scale, highlighting the significant relevance of the United States. When considering authors and co-authors, 29 countries are observed, with the United States maintaining the same position. England ranks second, and Germany ties with Brazil for third place in this ranking. Therefore, it is noteworthy that these prominent countries in the ranking consequently have a greater impact within this field.

Overall, the top 100 most cited studies were distributed across 14 different journals. Among these, the journals with the highest number of publications were the Journal of Clinical Periodontology (JCP), which began in 1974 and celebrated 50 years of publications in 2024, with an impact factor of 5.8, leading the ranking with 49 articles. This is followed by the Journal of Periodontology (JP), which began in 1930 with an impact factor of 4.2 and 37 articles among the most cited. Both journals have high impact factors and are considered leading references in the field of periodontology. The research identified 14 distinct publishers, with Wiley (W) publishing the majority of the studies, likely due to its extensive base of over 1,700 journals, including those with significant weight in this subject area.

The keyword analysis revealed that the most frequently used terms by the authors of the top 100 most cited articles were disease, periodontitis, therapy, inflammation, Porphyromonas gingivalis, gingival crevicular fluid, chronic periodontitis, and periodontal disease, as shown in Figure 10. The term “disease” was the most cited, indicating that “disease” is a broadly used term in the context of non-surgical periodontal treatment. These keywords highlight the main areas of interest for the authors in their publications and facilitate future searches for articles in this field.

Examining the temporal distribution of the 100 selected studies, it is evident that the years with the highest concentration of publications were 2005 and 2009, outlining a pattern where the most cited articles on the topic were published less than 20 years ago. The lack of a significant number of more recent articles among the top cited suggests that newer articles may not have had sufficient time to accumulate a high number of citations.

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CONCLUSION

It can be concluded that the majority of the top 100 most cited studies were clinical trials. The most cited authors were D'Aiuto et al., in 2004 [13], followed by Badersten et al., in 1981[14]. The most relevant institutions are the University of São Paulo, followed by the University of Texas and University College London. The Journal of Clinical Periodontology ranked as the leading source of the most cited publications.

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CONFLICT OF INTEREST

The authors declare that they have no conflict of interest in relation to this study.

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